2. A method as claimed in claim 1 wherein said step of creating said digital signal includes:

generating clock pulses,

counting the clock pulses and

causing said switching when the count of clock pulses reaches respective preset values.

3. A method as claimed in claim 1 wherein the repetition rate and duty cycle of said time-varying rectangular wave are controlled by the combination of a direct digital synthesiser and a comparator.

4. A method as claimed in claim 1 including fixing one of the repetition rate of said time-varying rectangular wave and the excitation frequency of said time-varying dipole excitation voltage and scanning another of said repetition rate and said excitation frequency whereby to vary sequentially the mass-to-change ratio of ions undergoing said resonant oscillatory motion.

5. A method as claimed in claim 1 wherein the repetition rate of said time-varying rectangular wave voltage and the excitation frequency of said time-varying dipole excitation voltage have a fixed relationship and including scanning said repetition rate and said excitation frequency through a predetermined range whereby sequentially to cause ions having different mass-to-change ratios to undergo resonant oscillatory motion.

6. A method as claimed in claim 1 wherein said time-varying rectangular wave voltage is a frequency-variable square wave voltage.

7. A method as claimed in claim 1 wherein said time-varying rectangular wave voltage has a DC offset.

8. A method as claimed in claim 1 wherein said quadrupole ion trap device is an ion trap device capable of generating a 3-D quadrupole electric field.

9. A method as claimed in claim 1 wherein said quadrupole ion trap device is an ion trap device capable of generating a 3-D quadrupole electric field and higher order multiple electric fields.

10. A method as claimed in claim 1 wherein said quadrupole ion trap device is a linear quadrupole ion trap device.

11. A method as claimed in claim 1 wherein said resonant oscillatory motion is capable of causing selective ejection of ions from said quadrupole ion trap device for detection by an external detector.

12. A method as claimed in claim 1 wherein said resonant oscillatory motion is capable of increasing the kinetic energy of ions trapped by the quadrupole ion trap device.

13. A method as claimed in claim 1 wherein said time-varying dipole excitation voltage has multi-frequency components and is capable of exciting ions within a mass range and inducing image current for image current detection.

14. A method as claimed in claim 1 wherein said time-varying dipole excitation voltage has a rectangular waveform and is also generated by controlling switches.

15. A method as claimed in claim 5 wherein said fixed relationship is that said excitation frequency is proportional to said repetition rate, and is achieved by a frequency divider.

16. An apparatus for driving a quadrupole ion trap device comprising,

means for creating a digital signal,

a set of switches arranged to be controlled by said digital signal causing the switches alternately to switch between a high voltage level and a low voltage level to generate a time-varying rectangular wave voltage which is supplied, in use, to said quadrupole ion trap device for trapping ions in a predetermined range of mass-to-charge ratio,

means for varying said digital signal to vary the predetermined range of mass-to charge ratio of ions that can be trapped by the quadrupole ion trap device and means for supplying to the quadrupole ion trap device a time-varying dipole excitation voltage to cause mass-selective resonant oscillatory motion of ions in the device.

17. An apparatus as claimed in claim 16 wherein said means for creating a digital signal includes means for generating clock pulses, means for counting the clock pulses and means for causing said switching when the count of pulses reaches respective preset values.

18. An apparatus as claimed in claim 16 wherein the repetition rate and duty cycle of said time-varying rectangular wave are controlled by control means including a direct digital synthesiser and a comparator.

19. An apparatus as claimed in claim 16 including means for fixing one of the repetition rate of said time-varying rectangular wave and the excitation frequency of said time-varying dipole excitation voltage and scanning another of said repetition rate and said excitation frequency whereby to vary sequentially the mass-to-charge ratio of ions undergoing said resonant oscillatory motion.

20. An apparatus as claimed in claim 16 wherein the repetition rate of said time-varying rectangular wave voltage and the excitation frequency of said time-varying dipole excitation voltage have a fixed relationship and including means for scanning said repetition rate and said excitation voltage through a predetermined range whereby sequentially to cause ions having different mass-to-charge ratios to undergo said resonant oscillatory motion.

21. An apparatus as claimed in claim 16 wherein said time-varying rectangular wave voltage is a frequency-variable square wave voltage.

22. An apparatus as claimed in claim 16 wherein said time-varying rectangular wave voltage has a DC offset.

23. An apparatus as claimed in claim 16 wherein said resonant oscillatory motion is capable of causing selective ejection of ions from said quadrupole ion trap device for detection by an external detector.

24. An apparatus as claimed in claim 16 wherein said resonant oscillatory motion is capable of increasing kinetic energy of ions trapped by the quadrupole ion trap device.

25. An apparatus as claimed in claim 16 wherein said time-varying dipole excitation voltage has multi-frequency components and is capable of exciting ions within a mass range and induce image current for image current detection.

26. An apparatus as claimed in claim 16 wherein said time-varying dipole excitation voltage has a rectangular waveform and is also generated by controlling switches.

27. An apparatus as claimed in claim 20 including a frequency divider for establishing said fixed relationship by maintaining said excitation frequency and said repetition rate in a fixed proportion.

32. A quadrupole ion trap device incorporating an apparatus as claimed in claim 16.

33. A quadrupole ion trap device as claimed in claim 32 being a 3D rotationally symmetric quadrupole ion trap device.

34. A quadrupole ion trap device as claimed in claim 32 being a linear quadrupole ion trap device.